DIFFERENTIATION OF AN ISOLATED PIECE OF A HYDROZOAN, CORYNE UCHIDAI STECHOW

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DIFFERENTIATION OF AN ISOLATED PIECE OF A HYDROZOAN, *CORYNE UCHIDAI* STECHOW

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Coryne uchidai Stechow (Stechow and Uchida 1931), a marine hydrozoan, establishes many colonies from late October on rocks and seaweeds in the tidal level of the coast in front of the Asamushi Aquarium. During the writer's study on the morphological structures visible in the life cycle of this species, she found several new facts and this report deals with the differentiation of the isolated piece.

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MATERIAL AND METHOD

Distinct colonies of *Coryne uchidai* Stechow began to appear with active hydranths on the rock surface or on the seaweeds in the low tidal zone of the coast in front of the Asamushi Aquarium from October every year. From October to February, the colony grew asexually increasing abundant hydranths. The sexual reproduction of the colony began from late March, and the male and female gonophores were observed on the hydranths until the beginning of June. After the sexual reproductive stage, the hydranths began to reduce and disappeared gradually. In July, the hydranths were not observed in this field except with the inactive stolons of the colony. The materials used in the developmental observations of the isolated piece were collected from February to April in 1957. The pieces used in the present investigation were cut from a part of the colony as described in the following observation. Each piece was reared in the Petri-dish in the laboratory using as food the larvae of the brine shrimp.

OBSERVATIONS

(1) *Regeneration of the isolated piece*: To observe the processes of the

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regeneration of the isolated piece of this species, three parts were isolated from the colony, the first part from the hydranth, the second the hydrocaulus and the third from the hydrorhyza. In the investigation, three pieces of each of these isolated parts were isolated in the Petri-dishes.

Regeneration of hydranth: The cut end was closed up completely in about two hours after the operation, and the secreted peridarmal substance at its cut end was attached to the surface of the glass bottom. After half a day, a difinite rounded outgrowth was visible, leaving a thin transparent ectodermal membrane at its cut end. It was the rudiment of the regenerating stolon (Fig. a, 1). As the stolon bud elongates, the distal end of the isolated hydranth rised to a vertical position. On the second day, the stolon became longer and the tentacles began to be absorbed (Fig. a, 2). On the third day, the stolon was more elongated, the tentacles were absorbed completely, and the original hydranth changed to a

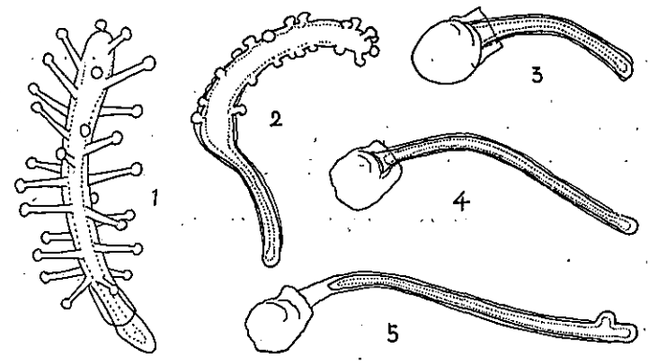

Fig. a. Developmental process of isolated hydranth of *Coryne uchidai*. ca.×15.
1. Appearance of a regenerated rudiment of stolon, 12 hours after isolation. 2. Elongation of stolon and absorption of hydranth. 3. Spherical vestige of absorbed hydranth. 4. Completely absorbed hydranth and elongated stolon. 5. Development of a rudiment of a hydranth on an elongated stolon.

spheroidal shape which was filled with red pigmented granules. In the stolon, those many pigmented granules moved in constant directions within the coenosarc. The directions were at first from polyp to stolon tip, then in the reverse direction when the granules accumulated fully at the tip. In the elongation of the new stolon, the coenosarc of the new part was surrounded with opaque white ectodermal tissue, and the tip of the stolon consisted of large and transparent cells (Fig. a, 3). On the fourth day, the reduced hydranth disappeared completely and the stolon tip continued to grow leaving only the empty membrane in the position of the

original piece, and a newly formed tube of perisarc was observed along stolon (Fig. a, 4). In the living material, the tissue at the reduced level of the piece became irregular and shrank a little back to the new perisarc. At the stage of reduction of original hydranth, several cells at the tip of the stolon were seen to grow upward or perpendicularly, and this group of cells was the rudiment of the hydranth (Fig. a, 5).

Regeneration of hydrocaulus: Here, the regeneration process of the apical

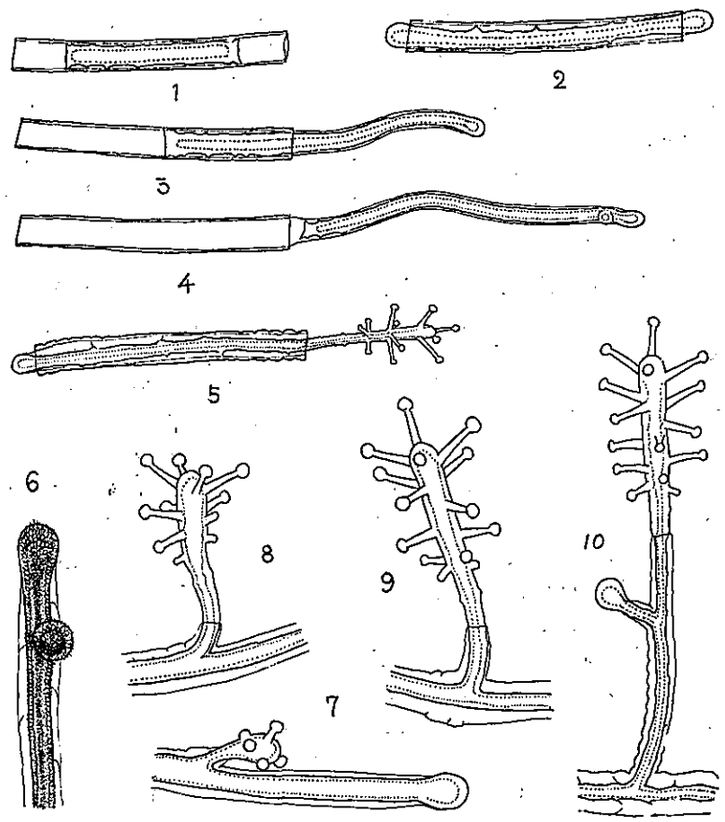

Fig. b. Developmental process of isolated hydrocaulus of *Coryne uchidai*. ca.×15.
1. The coenosarc shrunk in a perisarc, two hours after the isolation. 2. Beginning of regeneration of stolon at both cut ends. ca.×15. 3. Elongation of one cut end of stolon. ca.×15. 4. Development of rudiment of hydranth on a regenerated stolon. ca×15. 5. Formation of hydranth on a cut end of stolon. ca.×15. 6. Rudiments of the first bud of hydranth. ca.×30. 7. Young hydranth with rudiments of oral and second capitate tentacles. ca.×30. 8–10. Young hydranth with elongated capitate tentacles and hydrocaulus. ca.×30.

half of the hydrocaulus is described, because no different processes were found between the apical half and the basal half. For about five to six hours after the apical half was isolated, the tissue of the coenosarc shrank toward the middle center of the piece from both cut ends (Fig. b, 1). After the shrinkage of the coenosarc, it began to regenerate at both cut ends. Those buds of stolon were elongated to escape the cut ends of perisarc at both ends. But, soon, one of those buds adhered to the bottom of the glass and was much elongated, but the other end retreated into the original perisarc (Fig. b, 2 and 3). The elongated stolon escaped completely from the original perisarc, but the retreated parts did not always leave the original perisarc completely (Fig. b, 3). After about four or five days of isolation of the piece, the first bud of the hydranth was produced at the end of the elongated stolon in the same process as was observed in the piece of the hydranth (Fig. b, 4). Generally the bud of the hydranth was produced after the stolon was much elongated, but in some pieces the buds were produced at the end of the regenerated stolon soon after it had passed through the opening of the original perisarc (Fig. b, 5).

Regeneration of stolon : The pieces of the stolon 3 mm in length, same as the length of the piece of hydrocaulus, were isolated. All of these showed almost the same processes in regeneration as was observed in the piece of the hydrocaulus. But the elongation of the piece of the stolon was not so active as in the hydranth and hydrocaulus, and it required for its elongation a period twice as long as the other pieces.

(2) *Development of the hydranth* : No differences were observed between the developments of the hydranths from the regenerated stolons of the pieces of the hydranth, hydrocaulus and the stolon. In this paper, the process of the differentiation of the new hydranth from the isolated hydranth is described. The rudiment of the new hydranth appeared as a mass of cells which grew vertically at the tip of the elongated stolon as mentioned above. Then the mass of cells grew as a small hemispherical bud of a new hydranth (Fig. b, 6). About 15 to 25 hours after the appearance of the bud, three or five nematocyst knobs appeared on the upper end of the bud. These were the rudiments of oral capitate tentacles. About six to eight hours after the appearance of the oral capitate tentacle rudiment, the other two to four nematocyst knobs were produced under the former ones (Fig. b, 7). These new nematocyst knobs were the rudiments of the second capitate tentacles. After two days of the appearance of the bud of hydranth, the rudiments of the bud as well as the tentacles became elongated. Then the bud showed a young shape of the new hydranth. After three days, five to eight tentacles were observed on the young hydranth. In this stage, a soft and transparent new perisarc of the hydranth appeared at the base of the young hydranth. This appearance of the perisarc showed the differentiation of

hydrocaulus (Fig. b, 8). After five to eight days, the hydranth grew to about 1 mm to 1.5 mm in length with 15 to 18 tentacles, and the hydrocaulus grew to about five to 12 mm in length, and in this stage nearly completed structure of the adult polyp of this species was observed. Then a new bud of branch was produced on the hydrocaulus (Fig. b, 9 and 10). The oral tentacles were produced on a verticil on the top of the hydranth bud, and the next tentacles on a verticil appeared under the former verticil in a cross-like disposition. With growth of the hydranth, the regular developmental arrangements of the tentacles changed to irregular.

(3) Formation of the colony : Formations of the colonies from pieces were observed for a month in the Petri-dishes, and with almost the same processes in their formations. As mentioned above, generally the stolon elongated to one direction until about 10 to 20 polyps were produced. In this stage, the stolon was elongated also to the opposite direction from the initial piece. The colonies elongated along the axis of the initial isolated piece, and in all cases distinct branches elongated laterally to the original axis were rare, and the patterns were generally linear so far as the observation was carried out.

CONSIDERATION

To investigate the morphological structures in the life cycle of *Coryne uchidai* Stechow, the writer made observations in the field and in the laboratory. To obtain a colony in the laboratory, the isolated piece of the material in the Petri-dish was reared in the laboratory. By this method, the process of the regeneration of the cut piece, the differentiation of the hydranth from the piece and the formation of the colony were observed. And the same process of differentiation of the polyp as observed in the laboratory could also be observed in the colonies of asexual reproductive season in the field. In the development of the stolon, the bud of the hydranth appeared at first as a small mass of cells at the tip of the new stolon. Then the rudiments of the capitate tentacles and the hydrocaulus were produced respectively. In other words, in *Coryne uchidai*, the structure of the hydranth was developed directory from the stolon. According to Nakamura (1940), in *Syncoryne nipponica*, not only the capitate tentacles but the filiform tentacles which are not visible in its completed hydranth are produced in the developing hydranth of the isolated piece. In the development of *C. uchidai* such other structure of tentacle as was observed in *Syncoryne nipponica* was not observed. In *C. uchidai* this direct development of hydranth was observed in the development of the animal in the active season of asexual reproduction in the winter. In *C. uchidai*, the filiform tentacles also appear in the development in other cases, and this will be reported in following paper. In the formation of the colony during about 10 days, the initial pattern was comparatively linear

without lateral branches though that of the field was very complex. In *Cladonema uchidai* (Hirai and Kakinuma 1957), distinct lateral branches appeared to the original stolon for 13 days. This tendency of linear pattern of the colony of *C. uchidai* is supposed to be a characteristic of this species.

SUMMARY

Asexual reproductive differentiation of *Coryne uchidai* Stechow was observed on the regeneration of its isolated pieces in the Petri-dish in the laboratory and on the material in the field. The processes of the regenerations of the cut pieces of hydranth, hydrocaulus and stolon were described. The each cut piece was about 2–3 mm, in length. The hydranth is differentiated directly without the appearance of the filiform tentacle from the regenerated stolon. The colony has a tendency to show a linear pattern in its formation.

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